Just in Time Quick Check

Standard of Learning G.DF.2

Strand: Two and Three-Dimensional Figures

Standard of Learning G.DF.2

The student will determine the effect of changing one or more dimensions of a three-dimensional geometric figure and describe the relationship between the original and changed figure.

Students will demonstrate the following Knowledge and Skills:

a) Describe how changes in one or more dimensions of a figure affect other derived measures (perimeter, area, total surface area, and volume) of the figure.
b) Describe how changes in surface area and/or volume of a figure affect the measures of one or more dimensions of the figure.
c) Solve problems, including those in context, involving changing the dimensions or derived measures of a three-dimensional figure.
d) Compare ratios between side lengths, perimeters, areas, and volumes of similar figures.
e) Recognize when two- and three-dimensional figures are similar and solve problems, including those in context, involving attributes of similar geometric figures.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting and Prerequisite SOL: 7.MG.3, G.DF.1

Just in Time Quick Check G.DF.2

1. Cube A is similar to Cube B. The ratio of the volumes of the two cubes is 125:512. Find the ratio of their surface areas.

2. Andrew has two square pyramids with the same base. The volume of the larger pyramid is 8 times the volume of the smaller pyramid. How much greater is the height of the larger pyramid than the smaller pyramid?

3. The side lengths of square M are tripled to create square N. Create a statement to show how the area of square M and the area of square N are related.

4. Two different rectangular solids each have a volume equal to $240m^3$.

    a) Create dimensions for each of the two rectangular solids using integer values. Verify that this is possible.

    b) Are the two rectangular solids similar, congruent or neither? Justify your reasoning.

5. For the volume of a rectangular solid to double, which four of the following scenarios could occur? Explain why the other choices would not work.

    - The length could be doubled.
    - The width and height could be doubled.
    - The length or the width or the height could be doubled.
    - The width could be doubled.
    - The length and width could be doubled.
    - The length and the width and the height could be doubled.
    - The height could be doubled.
    - The length and height could be doubled.

6. A small cylindrical container holds 16 ounces of soup. A larger similar cylindrical container holds 128 ounces of soup. What is the relationship between the linear dimensions of the smaller container and the linear dimensions of the larger container?

G.DF.2 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. Cube A is similar to Cube B. The ratio of the volumes of the two cubes is 125:512. Find the ratio of their surface areas.

   A common misconception that some students may have is that the surface areas of similar solids change at the same rate as either the volume or the sides and perimeters. This may indicate that students do not understand that linear ratios must be found before area ratios when starting with volume ratios. Students making this misconception would benefit by exploring how the relationships between the sides, perimeters, areas and volumes change when comparing two cubes. Teachers are encouraged to demonstrate these changes through exploratory exercises.

2. Andrew has two square pyramids with the same base. The volume of the larger pyramid is 8 times the volume of the smaller pyramid. How much greater is the height of the larger pyramid than the smaller pyramid?

   A common misconception some students may have is thinking the height of the larger pyramid is two times greater than the height of the smaller pyramid. This may indicate that students believe the relationship between the two heights can be found using a cube root factor of 8. This may also indicate that students do not understand that changing the height of a square pyramid results in a figure that is not similar to the original figure. Two solids are similar if and only if they are the same type of solid and their corresponding linear measures (heights, base lengths, etc.) are proportional. Teachers are encouraged to model this concept using dynamic software to allow students to manipulate dimensions and then to analyze the resulting values for the volume.

3. The side lengths of square M are tripled to create square N. Create a statement to show how the area of square M and the area of square N are related.

   A common error students may make is assuming that the area of square N will also triple. This may indicate that students do not understand that all squares are similar and that if the sides increase at a ratio of a:b then the area of the square increases at a ratio of a^2:b^2. Students may benefit from exploring what happens to the areas of squares and cubes when all side lengths increase or decrease.

4. Two different rectangular solids each have a volume equal to $240m^3$.

   a) Create dimensions for each of the two rectangular solids using integer values. Verify that this is possible.

b) Are the two rectangular solids similar, congruent or neither? Explain your thinking.

A common error students may make is assuming that all rectangular solids with the same volume must be similar or congruent. Students with this misconception would benefit from working with manipulatives to build rectangular solids that have the same capacity. Another teacher strategy could include using dynamic software to create solids for this scenario to determine possible side lengths, height, and area.

5. For the volume of a rectangular solid to double, which four of the following scenarios could occur? Explain why the other choices would not work.
    - The length could be doubled.
    - The width and height could be doubled.
    - The length or the width or the height could be doubled.
    - The width could be doubled.
    - The length and width could be doubled.
    - The length and the width and the height could be doubled.
    - The height could be doubled.
    - The length and height could be doubled.

    A common error that some students may make is to assume that all the dimensions will double. This may indicate that students do not understand that the concept of how one or more-dimension changes affect volume. Teachers are encouraged to model this concept using dynamic software to allow students to double one or more dimensions at a time and then analyze the resulting values for the volume.

6. A small cylindrical container holds 16 ounces of soup. A larger similar cylindrical container holds 128 ounces of soup. What is the relationship between the linear dimensions of the smaller container and the linear dimensions of the larger container?

    A common misconception that some students may have is that if the volume increases at a 1:8 ratio then so will each dimension. This may indicate that students do not understand that the volumes of similar objects increase at a cubed ratio as compared to the linear dimensions of those objects. Students making this error may benefit from exploring what happens to volume as each dimension changes separately versus all the dimensions changing to maintain similarity. Teachers are encouraged to use dynamic software to explore these concepts with their students so that the students may draw conclusions as to how a volume change affects one or more dimensions. Throughout this discussion, students should be reminded that figures only maintain similarity if all dimensions change by the same ratio. Teachers could have the students use a DESMOS slider to investigate how the volume change affects each dimension.